Science and Technology/Engineering

STRAND 2: LIFE SCIENCE (Biology)

Topics Grades Pre-K – 2	Topics Grades 3 – 5	Topics Grades 6 – 8	Topics High School
Characteristics of Living Things Pages 39–41	**Characteristics of Living Things** Page 42–43	**Characteristics of Living Things** Page 44	--
--	--	**Structure and Function of Cells** Pages 47–49	**Cell Biology and Biochemistry** Page 51–53
--	**Systems in Living Things** Pages 45–46	**Systems in Living Things** Page 47, 50	**Anatomy and Physiology** Page 52, 54
Heredity Pages 55–57	**Heredity** Page 58	**Heredity** Page 59	**Genetics** Page 60–61
Evolution and Biodiversity Pages 62–64	**Evolution and Biodiversity** Page 67–68	**Evolution and Biodiversity** Page 69–70	**Evolution** Page 71–72
Living Things and Their Environment Pages 62, 65–66	**Living Things and Their Environment** Page 67–68	**Living Things and Their Environment** Page 69–70	**Ecology** Page 71–72

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Characteristics of Living Things

Science and Technology/ Engineering

Strand 2
Life Science (Biology)

Pre-K–2

Grade Level: Pre-K–2

Topic		Learning Standards as written	Essence of the Standard(s)
Characteristics of Living Things	**1**	Recognize that animals (including humans) and plants are living things that grow, reproduce, and need food, air, and water.	♦ Recognize that living things grow and reproduce ♦ Recognize the needs of living things
	2	Differentiate between living and nonliving things. Group both living and nonliving things according to the characteristics that they share.	♦ Identify living and nonliving things ♦ Recognize different life cycles
	3	Recognize that plants and animals have life cycles, and that life cycles vary for different living things.	

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades Pre-K–2

Less Complex ⟷ **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Characteristics of Living Things	♦ Match object- to -object , picture- to-picture or object-to- picture of plants and/or animals ♦ Track materials related to plants and/or animals, or lifecycles ♦ Shift focus from materials to speaker in an activity related to plants and/or animals, or lifecycles ♦ Grasp materials related to plants and/or animals, or lifecycles ♦ Use two hands to hold materials related to plants and/or animals, or lifecycles ♦ Release materials related to plants and/or animals, or lifecycles ♦ Move materials related to plants and/or animals, or lifecycles	♦ Match living things to their specific needs (e.g., food, air, and water) ♦ Sort objects into living vs. nonliving ♦ Match the immature/youth form and the mature/adult form of the same plant ♦ Match the immature/youth form and the mature/adult form of the same animal ♦ Identify specific characteristics that differentiate living from nonliving things ♦ Label the life cycle stages of a plant ♦ Label the life cycle stages of an animal ♦ Identify living versus non-living things	♦ Sequence the life cycle of a plant ♦ Sequence the life cycle of an animal ♦ Give examples of how living things change as they mature ♦ Describe the differences and/or similarities between immature/mature forms of the same plant ♦ Describe the differences and/or similarities between immature/mature forms of the same animal	♦ Describe the changes within a life cycle of a plant ♦ Describe the changes within a life cycle of an animal ♦ Summarize the findings from simple experiments to show that plants need food, water, and light to survive *Continue to address skills and concepts in this strand that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades Pre-K–2

Less Complex ← → **More Complex**

	ACCESS SKILLS The student will:	**ENTRY POINTS The student will:**
Characteristics of Living Things (continued)	♦ Orient materials related to plants and/or animals, or lifecycles ♦ Manipulate objects related to plants and/or animals, or lifecycles ♦ Locate objects partially hidden or out of sight needed in an activity related to plants and/or animals, or lifecycles ♦ Use one object to act on another in an activity related to plants and/or animals, or lifecycles ♦ Turn on technology in an activity related to plants and/or animals, or lifecycles ♦ Imitate action in an activity related to plants and/or animals, or lifecycles ♦ Initiate cause-and-effect response during an activity related to plants and/or animals, or lifecycles ♦ Sustain through response in an activity related to plants and/or animals, or lifecycles ♦ Gain attention during activity related to plants and/or animals, or lifecycles ♦ Make a request during an activity (e.g., request a turn) related to plants and/or animals, or lifecycles ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to plants and/or animals, or lifecycles ♦ Respond to materials related to plants and/or animals, or lifecycles ♦ Attend visually, aurally, or tactilely to materials related to plants and/or animals, or lifecycles	

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Characteristics of Living Things

Grade Level: 3–5

Topic		Learning Standards as written	Essence of the Standard(s)
Characteristics of Living Things	**1**	Classify plants and animals according to the physical characteristics that they share.	♦ Classify plants and animals ♦ Recognize the 4 major stages of an organism's life cycle: • birth • development/growth • reproduction • death ♦ Explain frog/butterfly life cycles
	3	Recognize that plants and animals go through predictable life cycles that include birth, growth, development, reproduction, and death.	
	4	Describe the major stages that characterize the life cycle of the frog and butterfly as they go through metamorphosis.	

ENTRY POINTS to Life Science Standards in Grades 3–5

Less Complex → **More Complex**

	The student will:	The student will:	The student will:
Characteristics of Living Things	♦ Sort plants vs. animals ♦ Identify the major stages of the life cycle of a frog ♦ Identify the major stages of the life cycle of a butterfly ♦ Identify organisms as plant or animal ♦ List shared physical characteristics among plants ♦ List shared physical characteristics among animals ♦ Identify the major stages of the metamorphosis of a frog ♦ Identify the major stages of the metamorphosis of a butterfly *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Explain how plants differ from animals ♦ Describe shared physical characteristics among plants ♦ Describe shared physical characteristics among animals	♦ Compare/contrast similarities and differences among a variety of plants ♦ Compare/contrast similarities and differences among a variety of animals ♦ Describe changes undergone by plants during their life cycles ♦ Describe changes undergone by animals during their life cycles ♦ Classify plants according to their shared physical characteristics ♦ Classify animals according to their shared physical characteristics ♦ Describe the process of metamorphosis *Continue to address skills and concepts in this strand that approach grade-level expectations*

Science and Technology/ Engineering

Strand 2
Life Science (Biology)

6–8

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Characteristics of Living Things

Grade Level: 6–8

Topic	Learning Standards as written		Essence of the Standard(s)
Characteris-tics of Living Things	**1**	Classify organisms into the currently recognized kingdoms according to characteristics that they share. Be familiar with organisms from each kingdom.	♦ Classify organisms by kingdom

ENTRY POINTS to Life Science Standards in Grades 6–8

Less Complex → **More Complex**

	The student will:	**The student will:**	**The student will:**
Characteris-tics of Living Things	♦ List the characteristics of one or more kingdoms ♦ List organisms by kingdom (Plants, Animals, Protists, Fungi, Archaebacteria, Eubacteria) *Continue to address earlier standards in this topic at a level that challenges the student*	♦ List similarities and differences among plants, animals, and other organisms ♦ Identify living organisms that are not plant or animal (e.g., fungi, bacteria) ♦ Classify organisms by kingdom (Plants, Animals, Protists, Fungi, Archaebacteria, Eubacteria)	♦ Organize plants, animals, and other organisms by similarities and differences *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Systems in Living Things

Grade Level: 3–5

Topic		Learning Standards as written	Essence of the Standard(s)
Systems in Living Things	**2**	Identify the structures in plants (leaves, roots, flowers, stem, bark, wood) that are responsible for food production, support, water transport, reproduction, growth, and protection.	♦ Identify plant structures and corresponding functions

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades 3–5

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	**ENTRY POINTS** The student will:	The student will:	The student will:
Systems in Living Things	♦ Match object- to -object , picture- to-picture or object-to- picture of one major body system ♦ Track materials related to one major body system ♦ Shift focus from materials to speaker in an activity related to one major body system	♦ Label basic structures in plants ♦ Identify simple functions of plant structures (e.g., stem –> transport; flower –>reproduce)	♦ Describe simple functions of plant structures (e.g., stem –> transport; flower –>reproduce)	♦ Describe how plants make their food with the help of sunlight and water ♦ Label basic plant structures and their functions *Continue to address skills and concepts in this strand that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades 3–5

Less Complex ← → **More Complex**

	ACCESS SKILLS The student will:	**ENTRY POINTS The student will:**
Systems in Living Things (continued)	♦ Grasp materials related to one major body system ♦ Use two hands to hold materials related to one major body system ♦ Release materials related to one major body system ♦ Move materials related to one major body system ♦ Orient materials related to one major body system (e.g., orient print material on the digestive system) ♦ Manipulate objects related to one major body system ♦ Locate objects partially hidden or out of sight needed in an activity related to one major body system ♦ Use one object to act on another in an activity related to one major body system ♦ Turn on technology in an activity related to one major body system ♦ Imitate action in an activity related to one major body system ♦ Initiate cause-and-effect response during an activity related to one major body system ♦ Sustain through response in an activity related to one major body system ♦ Gain attention during activity related to one major body system ♦ Make a request during an activity (e.g., request a turn) related to one major body system ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to one major body system ♦ Respond to materials related to one major body system ♦ Attend visually, aurally, or tactilely to materials related to one major body system	

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:

- Structure and Function of Cells
- Systems in Living Things

Grade Level: 6–8

Topic		Learning Standards as written	Essence of the Standard(s)
Structure and Function of Cells	**2**	Recognize that all organisms are composed of cells, and that many organisms are single-celled (unicellular), e.g., bacteria, yeast. In these single-celled organisms, one cell must carry out all of the basic functions of life.	♦ Recognize that cells are the basic structure of life ♦ Compare/contrast plant and animal cells ♦ Become familiar with cell structure and basic cellular functions
	3	Compare and contrast plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, cytoplasm, chloroplasts, mitochondria, vacuoles).	
	4	Recognize that within cells, many of the basic functions of organisms (e.g., extracting energy from food and getting rid of waste) are carried out. The way in which cells function is similar in all living organisms.	
Systems in Living Things	**5**	Describe the hierarchical organization of multicellular organisms from cells to tissues to organs to systems to organisms.	♦ Identify and describe systems in multicellular organisms
	6	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other.	♦ Identify the functions and interactions of the major organ systems of the human body

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades 6–8

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Structure and Function of Cells	♦ Track materials related to cell structure ♦ Shift focus from materials to speaker in an activity related to cell structure ♦ Grasp materials related to cell structure ♦ Use two hands to hold materials related to cell structure ♦ Release materials related to cell structure ♦ Move materials related to cell structure ♦ Orient materials related to cell structure ♦ Manipulate objects related to cell structure (e.g. manipulate 3D materials to create models of a cell structure) ♦ Locate objects partially hidden or out of sight needed in an activity related to cell structure	♦ Identify major organelles of plant cells ♦ Identify major organelles of animal cells ♦ Identify single-celled organisms	♦ Recognize that cells are living organisms ♦ Identify the function of major organelles in plant cells ♦ Identify the function of major organelles in animal cells ♦ Classify cells as either plant or animal	♦ Identify similarities and/or differences between plant and animal cells ♦ Compare and contrast major organelles of plant and animal cells *Continue to address skills and concepts in this strand that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades 6–8

Less Complex ⟷ **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:
Structure and Function of Cells (continued)	♦ Use one object to act on another in an activity related to cell structure ♦ Turn on technology in an activity related to cell structure ♦ Imitate action in an activity related to cell structure ♦ Initiate cause-and-effect response during an activity related to cell structure ♦ Sustain through response in an activity related to cell structure ♦ Gain attention during activity related to cell structure ♦ Make a request during an activity (e.g., request a turn) related to cell structure ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to cell structure ♦ Respond to materials related to cell structure ♦ Attend visually, aurally, or tactilely to materials related to cell structure	

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades 6–8

Less Complex ⟷ **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Systems in Living Things	*Access skills for this topic can be found under the Grade Level: 3–5 Learning Standards*	♦ Identify the levels of organization within multicellular organisms ♦ Identify human body systems ♦ Match human body parts to their corresponding systems (i.e., lungs to a respiratory system) *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Label the human body parts of the digestive system ♦ Label the human body parts of the respiratory system ♦ Label the human body parts of the circulatory system ♦ Label the human body parts of the reproductive system ♦ Label the human body parts that control movement and coordination ♦ Identify human body parts and their corresponding systems ♦ Label the parts of the skeletal system	♦ Demonstrate how organs interact in a larger system (e.g., parts of the respiratory system) ♦ Demonstrate how systems interact in the human body ♦ Describe the process of digestion ♦ Describe the process of respiration ♦ Describe the process of circulation ♦ Describe the process of reproduction ♦ Describe the process of movement and coordination ♦ Identify the function of the major human body systems *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:

- Cell Biology and Biochemistry
- Anatomy and Physiology

Science and Technology/ Engineering

Strand 2
Biology

High School

Grade Level: High School

Topic		Learning Standards as written	Essence of the Standard(s)
Cell Biology and Bio-chemistry	**1.1**	Recognize that biological organisms are composed primarily of very few elements. The six most common are C, H, N, O, P, S.	♦ Identify and describe the common elements that form living organisms ♦ Describe molecular structure and function for major categories of organic molecules ♦ Describe the role of enzymes in biochemical reactions ♦ Identify cell parts and describe their functions ♦ Compare and contrast prokaryotes and eukaryotes ♦ Identify and describe six kingdoms ♦ Identify and describe the purposes photosynthesis and cell respiration ♦ Describe the role of ATP in metabolism ♦ Describe the cell cycle and the process of mitosis ♦ Describe the processes of meiosis and fertilization ♦ Compare and contrast a virus and a cell
	1.2	Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).	
	1.3	Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, which have an effect on enzymes.	
	2.1	Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, and active transport).	
	2.2	Compare and contrast, at the cellular level, prokaryotes and eukaryotes (general structures and degrees of complexity).	
	2.3	Use cellular evidence (such as cell structure, cell number, and cell reproduction) and modes of nutrition to describe six kingdoms (Archaebacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).	
	2.4	Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.	
	2.5	Explain the important role that ATP serves in metabolism.	
	2.6	Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.	

Cell Biology and Bio-chemistry (cont.)	**2.7**	Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the process of fertilization.	
	2.8	Compare and contrast a virus and a cell in terms of genetic material and reproduction.	
Anatomy and Physiology	**4.1**	Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.	♦ Identify and describe the purpose, function, processes, and major components of each of the following systems: • digestive • respiratory • circulatory • nervous • muscular/skeletal • sexual reproductive ♦ Recognize that cells communicate in order to coordinate body functions ♦ Recognize that the body's systems interact to maintain homeostasis
	4.2	Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.	
	4.3	Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.	
	4.4	Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication between different parts of the body and the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.	
	4.5	Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscle, bones, cartilage, ligaments, tendons) works with other systems to support and allow for movement. Recognize that bones produce blood cells.	
	4.6	Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents.	
	4.7	Recognize that communication between cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.	
	4.8	Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.	

ENTRY POINTS to Biology Standards in High School

Less Complex ⟷ **More Complex**

	The student will:	The student will:	The student will:
Cell Biology and Biochemistry	♦ Identify common elements that form living organisms ♦ Classify foods as carbohydrates, lipids, or proteins ♦ Identify basic structures of cells (organelles) ♦ Explain the basic function of photosynthesis ♦ Illustrate the steps of cell reproduction ♦ Identify the reactants and products of photosynthesis *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Describe the primary functions of carbohydrates, lipids, and/or proteins ♦ Identify the differences between bacteria and viruses ♦ Label steps in the process of mitosis ♦ Label steps in the process of meiosis ♦ Identify the steps involved in body metabolism (conversion of fuel to energy from the food we eat) ♦ Identify basic structures of cells (organelles) and functions	♦ Compare and contrast categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids) ♦ Describe the importance of organic molecules to human organisms ♦ Identify the role of enzymes in breaking down organic molecules during the digestive process ♦ Compare and contrast a virus and a cell ♦ Describe the characteristics of one or more of the six kingdoms ♦ Explain how food is converted to energy during digestion ♦ Identify cell parts and describe their functions ♦ Compare and contrast the processes of mitosis and meiosis *Continue to address skills and concepts in this strand that approach grade-level expectations*

ENTRY POINTS to Biology Standards in High School

Less Complex ⟷ **More Complex**

	The student will:	The student will:	The student will:
Anatomy and Physiology	♦ Identify the function of the digestive system ♦ Identify the function of the circulatory system ♦ Identify the function of the respiratory system ♦ Identify the function of the nervous system ♦ Identify the function of the muscular/skeletal system ♦ Identify the function of the sexual reproductive system ♦ Identify major components of the muscular/skeletal system *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Identify the major organs of the digestive system and their functions ♦ Identify the major organs of the circulatory system and their functions ♦ Identify the major organs of the respiratory system and their functions ♦ Identify the major organs of the nervous system and their functions ♦ Identify the major organs of the muscular/skeletal system and their functions ♦ Identify the major organs of the sexual reproductive system and their functions ♦ Identify the major structures of the muscular/skeletal systems and their functions	♦ Explain the steps in the process of digestion ♦ Explain the steps in the process of circulation ♦ Explain the steps in the process of respiration ♦ Explain the steps in the process of reproduction ♦ Explain how cells communicate in order to coordinate the body's functions ♦ Explain how the body's systems interact in order to maintain homeostasis *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Heredity

Grade Level: Pre-K–2

Topic	Learning Standards as written		Essence of the Standard(s)
Heredity	**4**	Describe ways in which many plants and animals closely resemble their parents in observed appearance.	♦ Describe parent/offspring similarities and variations in appearance (plants and animals)

ENTRY POINTS to Life Science Standards in Grades Pre-K–2

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Heredity	♦ Match object- to -object , picture- to-picture or object- to-picture parent to offspring ♦ Track materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Shift focus from materials to speaker in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Grasp materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Use two hands to hold materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Release materials related to genes and/or offspring or DNA and/or Punnett squares	♦ Identify parents and offspring of different species	♦ Identify similarities between parents and offspring in plants ♦ Identify similarities between parents and offspring in animals	♦ Describe similarities and differences between parents and offspring of the same plant or animal ♦ Describe similarities and differences among offspring of the same parents (plant or animal) *Continue to address skills and concepts in this subject that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades Pre-K–2

Less Complex ⟷ **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:
Heredity (continued)	♦ Move materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Orient materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Manipulate objects related to genes and/or offspring or DNA and/or Punnett squares ♦ Locate objects partially hidden or out of sight needed in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Use one object to act on another in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Turn on technology in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Imitate action in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Initiate cause-and-effect response during an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Sustain through response in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Gain attention during activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Make a request during an activity (e.g., request a turn) related to genes and/or offspring or DNA and/or Punnett squares (e.g., make a request parent/offspring matching game) ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to genes and/or offspring or DNA and/or Punnett squares ♦ Respond to materials related to genes and/or offspring or DNA and/or Punnett squares ♦ Attend visually, aurally, or tactilely to materials related to genes and/or offspring or DNA and/or Punnett squares	

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Heredity

Grade Level: 3–5

Topic	Learning Standards as written		Essence of the Standard(s)
Heredity	**5**	Differentiate between observed characteristics of plants and animals that are fully inherited (e.g., color of flower, shape of leaves, color of eyes, number of appendages) and characteristics that are affected by the climate or environment (e.g., browning of leaves due to too much sun, language spoken).	♦ Distinguish between characteristics that are inherited and those that are not inherited

ENTRY POINTS to Life Science Standards in Grades 3–5

Less Complex → **More Complex**

	The student will:	**The student will:**	**The student will:**
Heredity	♦ Identify characteristics of plants and/or animals that are inherited (passed down from parents) ♦ Identify characteristics of plants and/or animals that are acquired (i.e., through climate or the environment) *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Identify variations in offspring within the same species	♦ Identify ways in which offspring are a composite of the features of each parent (plant/animal) *Continue to address skills and concepts in this subject that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Heredity

Grade Level: 6–8

Topic		Learning Standards as written	Essence of the Standard(s)
Heredity	**7**	Recognize that every organism requires a set of instructions that specifies its traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another.	♦ Describe the following as related to heredity: • relationship between traits and genes • heredity as the passage of traits from parent to offspring • sexual vs. asexual reproduction
	8	Recognize that hereditary information is contained in genes located in the chromosomes of each cell. A human cell contains about 30,000 different genes on 23 different chromosomes.	
	9	Compare sexual reproduction (offspring inherit half of their genes from each parent) with asexual reproduction (offspring is an identical copy of the parent's cell).	

ENTRY POINTS to Life Science Standards in Grades 6–8

Less Complex → **More Complex**

	The student will:	**The student will:**	**The student will:**
Heredity	♦ Compare and contrast characteristics (traits) of different plants/animals ♦ Distinguish between dominant and recessive traits in inherited characteristics *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Sort characteristics that are inherited (determined by genetics) and those that are not ♦ Identify organisms that reproduce sexually and those that reproduce asexually	♦ Determine the probability of inheriting a particular trait by using a Punnett square or other method *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Genetics

Grade Level: High School

Topic	Learning Standards as written		Essence of the Standard(s)
Genetics	**3.1**	Describe the basic structure (double helix sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.	♦ Identify and describe the following: • structure and function of DNA • DNA replication • mutations of DNA and implications • observed inheritance patterns • Mendel's laws of segregation and independent assortment and how these are evident in inheritance patterns • use of Punnett squares to determine probability of inherited traits
	3.2	Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.	
	3.3	Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.	
	3.4	Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles).	
	3.5	Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (such as dihybrid crosses).	
	3.6	Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.	

ENTRY POINTS to Biology Standards in High School

Less Complex ⟷ **More Complex**

	The student will:	The student will:	The student will:
Genetics	♦ Give examples to demonstrate that some genes are stronger (dominant) and some are weaker (recessive), making certain traits more or less likely to appear in offspring *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Describe how DNA is structured in a cell ♦ Perform a simple Punnett square genetic cross	♦ Describe how the cell's genetic code is mapped in its DNA ♦ Explain how DNA can change or mutate ♦ Illustrate principles of Mendel's laws *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)

Learning Standards for:

- Evolution and Biodiversity
- Living Things and Their Environment

Grade Level: Pre-K–2

Topic		Learning Standards as written	Essence of the Standard(s)
Evolution and Biodiversity	**5**	Recognize that fossils provide us with information about living things that inhabited the earth years ago.	♦ Identify the living organism a fossil is likely related to
Living Things and Their Environment	**6**	Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell, and taste.	♦ Name the five senses ♦ Recognize that people and animals interact with the environment using their senses ♦ Recognize that organisms change as seasons change (e.g., trees lose leaves in the fall) ♦ Identify ways an organism's habitat provides for its basic needs
	7	Recognize changes in appearance that animals and plants go through as the seasons change.	
	8	Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air, and shelter).	

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades Pre-K–2

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Evolution and Biodiversity	♦ Track materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Shift focus from materials to speaker in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Grasp materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Use two hands to hold materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms	♦ Identify the living organism to which a given fossil is most likely related	♦ Identify how fossils may have formed	♦ Identify the conditions under which a living organism became a fossil *Continue to address skills and concepts in this strand that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades Pre-K–2

Less Complex ⟷ **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:
Evolution and Biodiversity (continued)	♦ Release materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Move materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Orient materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Manipulate objects related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Locate objects partially hidden or out of sight needed in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Use one object to act on another in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Turn on technology in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Imitate action in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Initiate cause-and-effect response during an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Sustain through response in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Gain attention during activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Make a request during an activity (e.g., request a turn) related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to fossils adaptation and/or habitat or ecosystems or domains and kingdom(e.g., make a choice within 30 seconds of the construction paper color to create poster on animal kingdoms) ♦ Respond to materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms ♦ Attend visually, aurally, or tactilely to materials related to fossils adaptation and/or habitat or ecosystems or domains and kingdoms	

ENTRY POINTS and ACCESS SKILLS to Life Science Standards in Grades Pre-K–2

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:	The student will:	The student will:
Living Things and Their Environment	♦ Track materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology (e.g., track a lemon, a maraca, and a glitter ball in a lesson on senses) ♦ Shift focus from materials to speaker in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Grasp materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Use two hands to hold materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology	♦ Identify one or more of the senses by name and the part(s) of the body associated with that sense ♦ Illustrate seasonal changes in plants (e.g., change in leaf color, loss of leaves/flowers) ♦ Match animals and/or plants to their habitats	♦ Describe seasonal changes in plants and/or animals ♦ Identify ways humans and other living organisms meet their basic needs (e.g., humans build homes, birds build nests, rabbits burrow, etc.)	♦ Give examples of seasonal changes in plants/animals across all four seasons ♦ Describe how basic needs of living things are provided by their habitat (e.g., food, shelter, light, heat) *Continue to address skills and concepts in this strand that approach grade-level expectations*

ACCESS SKILLS (continued) to Life Science Standards in Grades Pre-K–2

Less Complex → **More Complex**

	ACCESS SKILLS The student will:	ENTRY POINTS The student will:
Living Things and Their Environment (continued)	♦ Release materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Move materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Orient materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Manipulate objects related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Locate objects partially hidden or out of sight needed in an activity related to senses, or seasons change, or food chain or food web, or photosynthesis, or ecology ♦ Use one object to act on another in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Turn on technology in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Imitate action in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Initiate cause-and-effect response during an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Sustain through response in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Gain attention during activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Make a request during an activity (e.g., request a turn) related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Choose within a specified amount of time (e.g., 30 seconds) from an errorless array in an activity related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Respond to materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology ♦ Attend visually, aurally, or tactilely to materials related to senses, or seasons change, or food web or food chain, or photosynthesis, or ecology	

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:

- Evolution and Biodiversity
- Living Things and Their Environment

Science and Technology/ Engineering

Strand 2
Life Science (Biology)

3–5

Grade Level: 3–5

Topic		Learning Standards as written	Essence of the Standard(s)
Evolution and Biodiversity	**6**	Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beak or feet, placement of eyes on head, length of neck, shape of teeth, color.	♦ Explain how the environment may affect inherited characteristics ♦ Explain the relationship between adaptation and survival within an environment
	7	Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).	
Living Things and Their Environment	**8**	Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment. Recognize that some animal behaviors are instinctive (e.g., turtles burying their eggs), and others are learned (e.g., humans building fires for warmth, chimpanzees learning how to use tools).	♦ Explain how organisms meet their needs through both instinctive and learned behaviors ♦ Identify animal and plant behaviors as they interact with their environment in order to survive ♦ Identify plant and animal behaviors that are seasonal ♦ Identify and describe how organisms make changes in their environment in order to survive and how these changes affect the environment ♦ Explain transfer of energy within a food chain
	9	Recognize plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward in response to gravity. Recognize that many plants and animals can survive harsh environments because of seasonal behaviors, e.g., in winter, some trees shed leaves, some animals hibernate, and other animals migrate.	
	10	Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.	
	11	Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.	

ENTRY POINTS to Life Science Standards in Grades 3–5

Less Complex → **More Complex**

	The student will:	The student will:	The student will:
Evolution and Biodiversity	♦ Describe differences among habitats ♦ Identify common plants and animals in a given area ♦ Identify features of a particular organism that enable it to survive in its habitat *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Identify changes in the environment that affect an organism's relationship with its environment	♦ Identify changes made by organisms in order to survive in a harsh environment *Continue to address skills and concepts in this strand that approach grade-level expectations*
Living Things and Their Environment	♦ Observe and classify behavioral and seasonal adaptations of plants and/or animals ♦ Document the effects of the sun on plant growth ♦ Identify producers, consumers, and/or decomposers *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Describe behavior as an organism's response to an external event in the environment ♦ Demonstrate how plants transfer energy within a food chain (e.g., producers to consumers to decomposers) ♦ Describe ways in which animals get energy from food they eat ♦ Describe how plants get energy by creating food from the sun and water ♦ Distinguish between learned and instinctive behaviors ♦ Identify changes made by an organism to its environment ♦ Describe differences in ecosystems	♦ Describe how transfer of energy from the sun affects all organisms in a food web ♦ Describe how organisms interact with and cause both beneficial and detrimental changes in their environment ♦ Describe how organisms are affected by changes in their environment *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Evolution and Biodiversity
- Living Things and Their Environment

Science and Technology/ Engineering

Strand 2
Life Science (Biology)

6–8

Grade Level: 6–8

Topic		Learning Standards as written	Essence of the Standard(s)
Evolution and Biodiversity	**10**	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.	♦ Identify causes of evolution and diversity ♦ Recognize evidence that can be used to explain the theory of evolution ♦ Recognize that if adaptations fail, extinction can occur ♦ Identify changes in ecosystems over time ♦ Recognize biological evolution as the minute changes that occur in an organism over many generations
	11	Recognize that evidence drawn from geology, fossils, and comparative anatomy provide the basis of the theory of evolution.	
	12	Relate the extinction of species to a mismatch of adaptation and the environment.	
	17	Identify ways in which ecosystems have changed throughout geologic time in response to physical conditions, interactions among organisms, and the actions of humans. Describe how changes may be catastrophes such as volcanic eruptions or ice storms.	
	18	Recognize that biological evolution accounts for the diversity of species developed through gradual processes over many generations.	
Living Things and Their Environment	**13**	Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.	♦ Provide examples of an organism's interactions within its ecosystem ♦ Recognize roles and functions within a food web ♦ Describe the process of photosynthesis ♦ Describe the process of decomposition
	14	Explain the roles and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.	
	15	Explain how dead plants and animals are broken down by other living organisms and how this process contributes to the system as a whole.	
	16	Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.	

ENTRY POINTS to Life Science Standards in Grades 6–8

Less Complex → **More Complex**

	The student will:	The student will:	The student will:
Evolution and Biodiversity	♦ Classify organisms as extinct or non-extinct ♦ Identify major catastrophes that can impact life on earth ♦ Compare how plants and animals of today are similar to their ancestors (e.g., woolly mammoth and elephant) ♦ Identify changes in the environment that can impact life on earth over greater increments of time ♦ Classify a species as endangered or non-endangered *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Demonstrate how organisms have changed over time by recognizing the differences between organisms today and their ancestors ♦ Describe changes in the environment that can impact life on earth over greater increments of time ♦ Identify a species that became extinct and the reasons why	♦ Explain and give examples of the concept of extinction ♦ Explain why a specific endangered species may become extinct ♦ Describe the effects of a catastrophe has on an ecosystem and the organisms within it *Continue to address skills and concepts in this strand that approach grade-level expectations*
Living Things and Their Environ-ment	♦ Explain how one organism affects another in its ecosystem ♦ Identify food sources in the environment of different animals ♦ Illustrate how energy from the sun is converted by plants into food (photosynthesis) *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Describe the elements of an ecosystem ♦ Classify animals as either herbivores (first-order consumers), carnivores (second-order consumers), or omnivores ♦ Describe how energy from the sun is converted by plants into food (photosynthesis) ♦ Create and/or label a food web	♦ Describe ways in which a plant or animal helps and/or harms the ecosystem ♦ Explain the impact of plant and animal decomposition on the environment ♦ Describe how transfer of energy from the sun affects all organisms in a food web *Continue to address skills and concepts in this strand that approach grade-level expectations*

CONTENT Science and Technology/Engineering
STRAND Life Science (Biology)
Learning Standards for:
- Evolution
- Ecology

Science and Technology/ Engineering

Strand 2
Biology

High School

Grade Level: High School

Topic		Learning Standards as written	Essence of the Standard(s)
Evolution	**5.1**	Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection.	♦ Explain physical evidence supporting evolution ♦ Describe classification and taxonomy of organisms based on their similarities ♦ Explain natural selection, evolution, and biodiversity ♦ Classify living organisms into domains and kingdoms
	5.2	Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.	
	5.3	Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.	
Ecology	**6.1**	Explain how birth, death, immigration, and emigration influence population size.	♦ Describe interactions among organisms and between their environments that influence population size and diversity ♦ Identify features of a food web ♦ Explain the roles of water, carbon, oxygen, and nitrogen in ecosystems
	6.2	Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.	
	6.3	Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, and mutualism) add to the complexity of biological communities.	
	6.4	Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.	

ENTRY POINTS to Biology Standards in High School

Less Complex → **More Complex**

	The student will:	The student will:	The student will:
Evolution	♦ Give examples of traits that make an organism more or less likely to survive (natural selection) *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Describe examples in the fossil record that support evolution ♦ Classify living organisms in a given phylum into class, order, family, genus, or species ♦ Show how animals with certain traits survive changes in their environment while animals with other traits do not ♦ Classify organisms into fungus, plant, or animal kingdoms	♦ Explain how organisms survive or are eliminated from the population through natural selection ♦ Explain how years of natural selection lead to evolution (major changes in species) ♦ Describe how a species has evolved over time (e.g., humans) *Continue to address skills and concepts in this strand that approach grade-level expectations*
Ecology	♦ Identify the components of a food web (e.g., sunlight, producer, consumer, and decomposer) ♦ Use the terms "abiotic" and "biotic" to classify parts of an ecosystem ♦ Identify producers, consumers, and decomposers in an ecosystem ♦ Identify predators, parasites, and competitors in an ecosystem ♦ Identify factors that can affect human population size *Continue to address earlier standards in this topic at a level that challenges the student*	♦ Make predictions about how changes in the environment (e.g., food supply, climate, introduction of predators) will affect the components of an ecosystem ♦ Classify contributors in a food web (e.g., producer, consumer, and decomposer) ♦ Classify producers, consumers, and decomposers in an ecosystem ♦ Classify predators, parasites, and competitors in an ecosystem	♦ Explain the roles of producers, consumers, and decomposers in an ecosystem ♦ Explain how predators, parasites, and competitors affect an ecosystem ♦ Explain how climate, natural causes, and/or human activity affect human population size ♦ Analyze changes in population size that result from natural causes, and/or human activity ♦ Explain the impact of non-native species on the environment *Continue to address skills and concepts in this strand that approach grade-level expectations*